

## Dr.A.J.Varma CV

**Dr.A.J.Varma**

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CSIR Emeritus Scientist

Former Chair and Chief Scientist, PSE

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### **Executive Summary :**

- *Ex-Chair and Chief Scientist of the Polymer Science & Engineering Division of CSIR-NCL*
- *Fellow of Biotech Research Society of India for outstanding contributions to Industrial Biotechnology (Thiruvananthapuram, Nov., 2011)*
- *CSIR-NCL Scientist-of-the-year Award 2011 for outstanding research (Pune, Jan., 2012)*
- *Achievement Award in Cellulose Chemistry and Technology by Association of Carbohydrate Chemists & Technologists of India, (Dehra Dun, Jan., 2014)*
- *Professor B.D. Tilak Visiting Fellowship by ICT, Mumbai (Mumbai, 2013-14)*
- *VASVIK Industrial Research Award winner for Chemical Technology (Gujarat, Oct.,2011)*
- *UNIDO-ICS Expert Group Member on Biomass Valorization (Trieste, Italy, 2006-2011)*
- *Professor S.Sethna Visiting Professor at Sardar Patel University (Anand, 2005)*
- *Editorial Board Member of Elsevier Journal "Carbohydrate Polymers" (UK) (2004-contd.)*
- *Editorial Board Member of "Trends in Carbohydrate Research" (India) (2009-contd.)*
- *President, Society of Polymer Science (India) (Pune Chapter) (2012-contd.)*
- *Invited Speaker and Chairperson at Symposia in many countries- USA, UK, Germany, Italy, China, Turkey, Denmark, Egypt, France, Sweden, Denmark, S. Africa, (1995-2011)*
- *Invited to deliver "Distinguished Alumni Lecture" in State Univ. Of New York, USA (2000)*
- *Transferred technologies to industry, industrial consultant to many industries, led large industrial & basic research projects, nodal officer for CSIR Biomass Program (2012-2017)*
- *Press reports in several national and international newspapers, magazines, and technical journals for work done by his group.*
- *Member of Scientific Panels of Ministry of Health and Ministry of New and Renewable Energy*

**Personal :** Born Lucknow, India, November 17, 1952

**Education :** **Ph.D.**, State University of New York, Syracuse, New York, USA, (1979).

**Ph.D.**, Syracuse University, New York, USA, (1979)

**Post-doctoral** Research, State Univ. of New York, USA (1979-1980)

**B.Sc.** (Hons, Chemistry), Fergusson College, Pune, (1973)

**Papers / Patents : 100 papers and 12 patents; 4 technologies transferred.**

### **Research Experience and Interests :**

Cellulose, nanocellulose, and functionalized nanocellulose platforms and building blocks. Developing research methodology for sustainable products from Biomass by synergizing biotechnology and chemical methodologies;

Leading a large interdisciplinary team of scientists (organic chemistry, polymer chemistry, biotechnology, process development) for concept-to-product chemicals delivery.

**Details of Major Awards, Honors, Recognitions :**

1. **“Life-time Achievement Award”** by Association of Carbohydrate Chemists & Technologists of India for contributions to Cellulose Chemistry and Technology (**20 Jan., 2014**)
2. **“Professor B.D.Tilak Visiting Fellowship Endowment”** for the year 2013-2014 (**03 Dec. 2013**)
3. **NCL Scientist-of-the-Year Award** given by NCL Research Foundation for outstanding work on Biodegradable Polymers and Biomass Fractionation Technology (**03 January, 2012**)

The Biomass Fractionation Technology has also been selected as being amongst the Top 10 High Impact Technologies of CSIR-NCL since inception of NCL, during the 70<sup>th</sup>. Anniversary of CSIR in 2012.

4. **Selected as Fellow of Biotech Research Society of India** for outstanding contributions to advancement of Industrial Biotechnology (**21 November, 2011**)
5. **Certificate of Appreciation from American Chemical Society Publications** for valuable contribution and dedicated service in peer review for ACS Journals (**December 2011**)
6. **VASVIK Award** for Chemical Sciences & Technology (2008) for work leading to a multi-purpose biorefinery and for technology development of a new high-pressure steam process to get value-added cellulose, hemicelluloses and lignin from biomass (**Oct. 2010**)
7. **Director’s Commendation Award at NCL Foundation Day** for successfully commissioning a demonstration plant on waste biomass to value-added polymers (**January 2008**)
8. Invited and serving as **Editorial Board Member** of prestigious international scientific journal in chemistry **“Carbohydrate Polymers”** (Elsevier Press, UK) (**2004 - 2012, continuing**)
9. Invited and serving as **Editorial Board Member** of **“Trends in carbohydrate Research”** (India) (**2009 –Continuing till date**)
10. **Elected as President, Society of Polymer Science, India (Pune Chapter)** (**July 2009, continuing till date**)
11. **Elected as Executive Body Member, Association of Carbohydrate Chemists & Technologists (India)** (**Jan. 2014**)
12. Professor S.Sethna **Visiting Professor in Chemistry** at Sardar Patel University (2004)
13. **University Grants Commission Expert Member** for setting up Center of Excellence in Applied Polymers at Sardar Patel University, Gujarat (2004-2006)

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14. **Expert Group Member** Meeting on Evaluation of Forefront Technologies in Environmentally Degradable Polymers, ICS-UNIDO, Italy (2005, 2009)
15. **Session Chairman and invited lecture** at International Conference, Trieste Italy (2008, 2009)
16. **Session Chairman and invited lecture** at International Conference Cairo, Egypt (2008),
17. **Invited lecture** at Beijing, China for Conf. on **Green Materials for Green Olympics** ( Oct. 2007)
18. **Invited to organize** International Conference on “Sustainable Plastics for India and Asian Countries” by ICS-UNIDO, at NCL, Pune, (2006)
19. **Specially invited speaker at scientific fora / conferences in (1995 – 2008)**  
USA, UK, Germany, Sweden, Denmark, Turkey, France, China, Egypt, Italy, India
20. Invited to deliver “**Distinguished Alumni Lecture**” at College of Environmental Science and Forestry, State University of New York, USA (2000)
21. **Nine scientific publications selected as Top 10 papers of prestigious research journals** like “JCS ChemComm”, “Green Chemistry”, and “Carbohydrate Polymers”, (2002- 2009)
22. **Article in “Nature”** high-lighted work done by Dr.Varma (2003) on biodegradable polymers synthesis strategy
23. **Chairman and member of several committees at local and national level** (UGC Experts Committee, UNIDO Experts Committee, Chairman of Purchase Committee of NCL, Member of CSIR SRF Committee, Member of selection committees for scientists and staff, Represented NCL/CSIR at Planning Commission meeting, Jan. 2008, etc.)
24. **MRF Award for Best scientific & technological work in elastomers in India** (1988)
25. **Research Foundation Award of New York for Ph.D. & post – doctoral research** (1974-1980)
26. **National Science Talent Search Scholar of India** (1971-74)
27. Basic and Applied work done in Dr. Varma’s lab has been **highlighted in several National and International newspapers, magazines, and technical journals**
28. **Member of Scientific Panel** of Food Safety and Security Authority of India, Ministry of Health, new Delhi (2014-15)

**Papers chosen as hottest “Top 10” papers of respective journals published by Dr.A.J.Varma in the last 10 years**

1) Towards biodegradable polyolefins : strategy of anchoring minute quantities of monosaccharides and disaccharides onto functionalized polystyrene, and their effect on facilitating polymer biodegradation  
P. Galgali, **A.J.Varma**, U.S.Puntambekar, and D.V.Gokhale  
JCS ChemComm, 23, 2884-2885 (2002)

- 2) Lactic acid production from waste sugarcane bagasse derived cellulose  
Mukund G. Adsul, **Anjani J. Varma** and Digambar V. Gokhale, *Green Chem.*, 2007, **9**, 58
- 3) Utilization of sugarcane bagasse cellulose for producing cellulose acetates: Novel use of residual hemicellulose as plasticizer  
H.M.Shaikh, K.V.Pandare, G.Nair, and **A.J.Varma**  
*Carbohydrate Polymers*, 76, 23-29 (2009)
- 4) Complexation of heavy metals by crosslinked chitin and its deacetylated derivatives  
K.D.Trimukhe and **A.J.Varma**  
*Carbohydrate Polym.*, 71, 66-73 (2008)
- 5) Metal complexation by chitosan and its derivatives: A review  
**Varma, A.J.**, Deshpande, S.V., Kennedy, J.F.  
(2004) *Carbohydrate Polymers*, 55 (1), pp. 77-93.  
**(All-time highest rated review paper in this journal)**
- 6) Synthetic Polymers Functionalized by Carbohydrates: A Review  
**A.J.Varma**, P.Galgali, and J.F.Kennedy  
*Carbohydr. Polym.* 56(4), 429-446, (2004)
- 7) Enzymatic hydrolysis of delignified bagasse polysaccharides  
M.G.Adsul, J.E.Ghule, R.Singh, H.Shaikh,K.B.Bastawde, D.V.Gokhale, and **A.J.Varma**  
*Carbohydr. Polym.* 62(1), 6-10 (2005)
- 8) Lignin-carbohydrate complexes from sugarcanebagasse : preparation, purification, and characterization  
R. Singh, S. Singh, K. D. Trimukhe, K. V. Pandare,K. B. Bastawade, D. V. Gokhale, and **A. J. Varma**  
*Carbohydr. Polym.* 62(1), 57-66 (2005)
- 9) Polysaccharides from Bagasse : Applications in Cellulase and Xylanase Production  
M. G. Adsul, J.E. Ghule, R. Singh, H. Shaikh,K.B. Bastawde, D.V. Gokhale,  
**A.J. Varma**,  
*Carbohydr. Polym.* 57(1),67-72, (2004)

## Appendix 1

### Highlights of Industrial Technology Achievements :

- 1 Successfully set up a semi-commercial industrial pilot plant to demonstrate and validate the cutting-edge laboratory developed science & technology **to chemically fractionate waste agricultural biomass** residues like sugarcane bagasse, into highly pure cellulose (cotton-like purity), xylan (which is converted to xylose and then xylitol as a safe sugar for preventing dental caries and diabetes), and lignin (which is converted to lignosulfonates of use as super-plasticizer in cement). This technology seeks to position developing countries with high agricultural economies **as global innovation and technology leaders in this important field of green chemistry**, wherein not only are annually available biomass is value-added, but it is also a replacement for the scarce petroleum, and **serves to save energy and green house gas effects. Value-addition to farmers, and meets a societal need. Commercial plant of 50,000 TPA under construction.**

**(Awarded NCL Scientist-of-the-year Award, 2011; VASVIK Award 2011 award given by Shri Narendra Modi; Director's Commendation Award, NCL, Jan. 2008)**

- 2 My work on **developing a new strategy to develop biodegradable environment friendly polymers** has attracted world attention. The work was lauded by an article appearing in the world's best known journal **"Nature"** (Science Updates, December 11, 2002, web edition, entitled **"Sugar turns Plastic Biodegradable . Bacteria make a meal of sweetened polythene and polystyrene"**). It was also described by **"Appropriate Technology"** (2003), a UK based journal, taking note of appropriate technologies in the third world. Newspapers across the world brought out articles describing this work, and science editors of **"Wall Street Journal"** and **"BBC"** also called to discuss the work. **UK based "Plastics in Packaging"** (2003) did a world survey on **"Mother Nature's Writing"** to describe natural renewable resources as materials for the future, and they focused on few important groups working in the field, and started with our work.
- 3 **Developed a break-through technology for preparing engineered shape and size nanoparticles of functionalized cellulose for use as anti-microbial and anti-TB material.**
- 4 **Transferred Hypalon Technology to M/s Shriram Rayons, Kota, Rajasthan**  
(Won MRF Award, 1988 for this development)

- 5 Developed technology for improving shelf-life of grapes for grape farmers (Maharashtra State Grape Growers Association / Tasgaon Sheti Seva & Drakshkul Pvt. Ltd.)

**Other Research and Development Contributions : Brief Description**

1. **Developed chemistry of renewable organic raw materials such as cellulose, xylans, lignins, chitosans, and related polysaccharides by establishing an internationally recognized school of research with publications in top-most journals.**
2. **Green technology and chemistry** : Work with nature derived materials (used plant biomass, vegetable oils) as replacement for petroleum derived materials; environment friendly processes based on minimizing organic solvents
  - **use of ionic liquids instead of halogenated hydrocarbons**
  - **use of natural materials** (natural polymers and natural monomers)
  - **use of biotechnology** (enzyme and microorganism mediated synthesis) for effecting transformations to produce high value chemicals like lactic acid, xylose, chitooligosaccharides, etc.
3. **Developed nanotechnology of functionalized cellulose.** In particular, succeeded in engineering the shape and size of carboxycelluloses which have many biomedical applications.
4. Developed nanolignins from sugarcane bagasse with the lowest particle sizes reported. These have industrial potential.
5. **Biodegradable and Environmentally Friendly Polymers:** Developed new methodology for preparation of biodegradable environmental friendly polymers by using sugars linked to un-degradable polymers Composites of Natural Polymers.
6. **Polymers in Sustainable Development using Environment Friendly Natural Polymers and Non-Edible Vegetable Oils :**
  - **Value addition from waste agricultural residue biomass materials** (like sugarcane bagasse, wheat straw, rice straw, jute, etc.) **to promote Carbohydrate Economy** by deriving from them industrial polymers like Pure

Cellulose, Hemicellulose (Xylan) and Lignins, and industrial platform chemicals like lactic acid and xylose (2002- continuing). Further, work on conversion of waste bagasse derived cellulose to biodegradable plastics like cellulose acetate for use as agriculture mulch film, carboxymethyl cellulose as biodegradable water soluble polymer, and methyl cellulose as food additive, lignin to lignosulfonates as super-plasticizer in cement, and xylose to xylitol is continuing.

- Sugar-linked polystyrenes and polyolefins as **biodegradable polymers** (2001- continuing). Great potential as a new and innovative solution to environmental degradable polymers.
- Development of industrial products like heavy metal complexing agents and chitooligosaccharides as anti-microbial agents, **from ocean derived natural polymers** like Chitin (2003 . continuing)
- Non-edible vegetable oils like cashew nut shell liquid converted to high value polymerizable monomers like hydroxyoctyl phenol and carboxyoctyl phenol (1999 . 2001)
- Heat resistant cellulose fibres for use in polymer composites as replacement for glass fibres (1997- 1998)
- Non-edible vegetable oils like Castor oil for production of chemicals, polymers, and polymer composites, especially polyurethanes and new diol monomers based on castor oil derived hydroxystearates (1993 . 1995)
- Agriculture derived polymers like Starch and Cellulose as reaction-incorporated biodegradable fillers in plastics (1984 . 1995)

## Appendix 2

### Countries Visited : Brief Description

#### Invited to deliver invited lectures at several international fora / conferences / meetings worldwide (last 10 years): (partial list)

- **Italy (2011)** : Invited to be part of Expert Group on Biomass Valorization discussion group.
- **Mauritius (2010)** : Member of High Power Delegation of Government of India to discuss bilateral S & T Cooperation
- **Italy (2009)** Invited to give lecture at ICS-UNIDO Conference on Biofuels and chair a session (21-23 April 2009)
- **Italy (2008)** : Invited to give lecture at ICS-UNIDO Conference on Biofuels and chair a session (18-20 September 2008)
- **Egypt (2008)** : Session chairman and invited lecture at UNIDO Conference at Cairo, Egypt (29-30 March 2008)
- **China (2007)** : Invited lecture %Biomass based Green Economy for Future Generations+at the International Conference on %Green Materials for Green Materials+sponsored by ICS-UNIDO, (26-29 Oct. 2007)
- **India (2006)** : Invited lecture, Carbohydrate Conference of Association of Carbohydrate Chemists and Technologists, New Delhi
- **Italy (2005)** : Expert Group Meeting of UNIDO - ICS to discuss status of Environmentally Degradable Polymers, and for invited lecture %Country Report on Promotion of Sustainable Plastics use and EDP\$ in India+ (5 Dec. 2005)
- **India (2005)** : Invited lecture, ICAR Conference on Roots and Tuber Crops, Trivandrum (July 2005)
- **India (2004)** : 1. Invited lecture, All-India Plastic Manufacturers Research Association, lecture on Biodegradable Polymers 2. Invited lecture, Carbohydrate Conference of Association of Carbohydrate Chemists and Technologists, Dehra Dun
- **India (2003)** : Invited lecture at Indo-French Symposium under IFCPAR, Synthesis of renewable resources based biodegradable polymers, Feb. 12, 2003
- **India (2001)**: Invited talk entitled %Prospects for Biodegradable Plastics based on Utilization of Renewable Resource Polymers+, International Conf. in New Delhi, Ministry of Environments and Forest
- **Denmark (2000)**, Special invitation to discuss collaborative research and to give invited lecture %Modified Natural Polymers and their

Applications+, at Agricultural University in Copenhagen (2-4 April, 2000)

- **USA (2000)**, special invitation as Distinguished Alumni Lecture Series, gave lecture %Environment-friendly Natural Polymer Composites+(7 April 2000)
- **USA (2000)**, attended conference on Building Blocks from Wood, gave research poster on %Cellulose powder as a component of thermoset resins : characterization, functionalization and curing studies+and department visit invitation (8-13 April 2000)
- **Germany (1999)**, International Conference on Bioplastics, invited lecture on %Overview of Bioplastics+, adjudged to be amongst top 3 speakers (23-25 June, 1999)
- **Sweden (1998)**, conference on biodegradable / environment friendly polymers, poster paper %Applications development studies of oxidised polysaccharides : biodegradability studies+(8-13 June 1998)
- **Turkey (1998)**, invited lecture on %Biodegradable Polymer Materials in India : Strategy for the Future+at UNIDO Conference (12-19 September, 1998)
- **U.K. (1995)**, special invitation from the BioComposites Centre, UK, for research discussions & for invited lecture on %Structural studies, reactions, & applications of renewable resource polymers+(20-27 March 1995)

### Appendix 3

## Applied Projects / Industrial Consultancy Reports

### Industrial Chemistry Projects and Consultancy Reports (Project Leader Dr.A.J.Varma)

Provided leadership and concept-to-delivery to time-targeted Projects / Consultancy and technical consultancy reports for several industries in India and MNCs, such as :

1. Appointed as Nodal Officer for entire CSIR 12 Five Year Plan Biomass Program (6 CSIR laboratories) (2012-2017)
2. Biofuel Program (multi-institutional, NMITLI) : CSIR-Industry project on Waste agricultural residues (natural products) to biofuel (ethanol) (2007-2012)
3. CSIR-Industry project on Waste agricultural residues to value-added polymer products (two projects) (2002-2007) (successful from from lab scale to pilot plant installation, commissioning, and demonstration at industrial site) .  
**(AWARD WINNING TECHNOLOGY) ( 2002-2007)**
4. Nitrex Chemicals, Gurgaon, (Consultancy Report on Methyl cellulose) (2004)
5. Pidilite Industries, Mumbai, (Consultancy report on Hydroxyethylcellulose) (2005)
6. General Electric, USA, (Project and report on Heat stable cellulose) (1996-1998)
7. General Electric, USA, (Building blocks for polycarbonates from naturally occurring materials : Cashew Nut Shell Liquid based polymerizable monomers, US Patent received) (1998-2001)
8. Unilever, UK, (Castor oil based polyurethanes and monomers) (1992-1995)
9. Rallis India, Mumbai, (Project and Consultancy Report on Grape guard for shelf life improvement of grapes) (1989-1991)
10. Pudumjee Pulp and Paper Mills, Pune, (Consultancy report on Bagasse lignin characterization) (1991-1992)
11. Shriram Rayons, Kota, (Technology for chlorosulfonated polyethylene) (two projects) (1985-1990)
12. TVSSM (Farmers Cooperative Society)) (Consultancy, Grape guard usage) (1983-1984)

## Thesis Supervised (B.Tech., M.Sc., M.Tech., and Ph.D degrees)

1. Functionalized nanoparticles from cellulose  
**Ph.D. Thesis**, P.R. Sharma, CSIR Academy (29 September, 2014)
2. Isolations, purifications, and applications of cellulose derived from bagasse and study of dialdehyde cellulose  
**Ph.D. Thesis**, H. Shaikh, Pune University, (Jan. 21, 2011)
3. Synthesis and study of biodegradable elastomers  
**Ph.D.Thesis**, R. Singh, Pune University, (Dec 31, 2010)
4. Crosslinking reactions of chitosan and their applications  
**Ph.D. Thesis**, K D Trimukhe, (April 10, 2009)
5. Pretreatment of sugarcane bagasse at pilot plant level : effect of morphology  
**Ph.D. Thesis**, S.Pal, Pune University (to be completed 2015)
6. Biodegradable Polymers Based on Naturally Occurring Substances  
**Ph.D. Thesis**, P. Galgali, Pune University (December 2004)
7. Structural studies, reactions and applications of oxidised celluloses  
**Ph. D. Thesis**, V B Chavan, Pune University (1995)
8. Antibacterial materials from Biobased Materials  
**M.Tech. Thesis**, S. Dutta, Manipal Inst. Of Technology (May 2014)
9. Studies in dispersion stability of carbon nanotubes in the presence of series of synthetic and natural polymers, preparation of their Nanocomposites, and evaluation of surface electrical conductivity  
**M.Tech. Thesis**, Neelam Aliya, Centre of Converging Technologies, University of Rajasthan, Jaipur (May 2014)
10. Preparation of Nanocellulose from Cotton linters  
B.Tech. thesis, Yadwinder Singh, Sri Guru Granth Sahib World University, Punjab (Aug. 2014)
11. Plastics degradation,  
BE Thesis, P Bhadane and A Surana, PRE College, Pune University (1998)
12. Blends of starch and PET as Biodegradable Polymers  
BE Thesis, P G Deshpande, N M Chaudhari, and A Paradkar, MIT College, Pune University (1998)

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13. Jute and Thermoplastic Polymer Blends/Composites  
B.E. Thesis, A Venkataraman and A Rawal, MIT College, Pune University (1999)
14. Blending of Jute and Polystyrene  
B.Tech. Thesis, G Ninad, Dr. Babasaheb Ambedkar Tech. University, Lonere (2000)
15. Multiphase polymers . Jute / Polystyrene Blends,  
BE Thesis, Y Parulekar, P mathur, and R Arora, MIT College, Pune University (2000)
16. A study of functionalized synthetic polymer and natural polymer blends  
BE Thesis, R Shevde, P Deore, and N Bhandarkar, MIT College, Pune University (2003)
17. Comparison of a biocatalyst with a chemical catalyst in carrying out esterification reactions  
M.Sc.Thesis, A Paul, Abeda Inamdar Sr.College, Pune University (2006)
18. Blends of chlorinated elastomers  
B E Thesis, S C Manwani, A J Padmanabhan, and K V Koundinya, Maharashtra Institute of Technology, Pune University (1990)
19. Pretreatment of Biomass for ethanol production  
Ph.D. thesis in progress, S.Pal (to be completed Dec. 2015)

Appendix 4

List of Publications of Dr.A.J.Varma :

- 101 Nanoparticles of specific shape and size derived from natural polymer cellulose show anti-microbial and anti-Tuberculosis activity  
Priyanka R. Sharma,<sup>1</sup>Sunil Kamble, Dhiman Sarkar, Amitesh Anand & A. J. Varma (Manuscript, 2014)
- 100 Supramolecular transitions in native cellulose I during progressive oxidation reaction leading to quasi-spherical nanoparticles of 6-carboxycellulose  
P.R.Sharma and A.J.Varma,  
Carbohydrate Polymers 113, 615- 623, 2014
- 99 Thermal stability of cellulose and their nanoparticles : Effect of incremental increases in carboxyl and aldehyde groups  
P.R.Sharma and A.J.Varma, vv  
Carbohydrate Polymers 114, 339-343 (2014)
- 98 Functionalized celluloses and their nanoparticles: morphology, thermal properties, and solubility studies  
P.R.Sharma and A.J.Varma  
Carbohydrate Polymers, 104, 135-142 (2014)
- 97 Functional nanoparticles from cellulose: engineering the shape and size of 6-carboxycellulose  
P.R.Sharma and A.J.Varma  
Chem. Commun. 49, 8818-8820, (2013)
- 96 Some aspects of cellulose hydrolysis  
P.R.Sharma, K.D.Trimukhe, and A.J.Varma  
Trends in Carbohydrate Research, 5(2), 7-11 (2013)
- 95 Biodegradation of Styrene-Butadiene-Styrene Copolymer via sugars attached to the polymer chain  
Rakesh Singh, Ramesh Chander Kuhad, ,Rishi Gupta, Mukund G. Adsul, Digambar V. Gokhale, Anjani J. Varma  
Advances in Materials Physics and Chemistry, 3, 112-118 (2013)
- 94 Towards biodegradable elastomers : green synthesis of carbohydrate functionalized styrene-butadiene-styrene copolymer by click chemistry  
R.Singh and A.J.Varma  
Green Chemistry, 14, 348-356 (2012).
- 93 Enhanced enzymatic hydrolysis of cellulose by partial modification of its chemical structure  
H. M. Shaikh, M. G. Adsul, D. V. Gokhale and **A. J. Varma**  
Carbohydrate Polymers (86(2), 962-968 (2011)

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- 92 Microbial production of xylitol from D-xylose and sugarcane bagasse hemicellulose using newly isolated thermotolerant yeast *Debaryomyces hansenii*  
Gyan Prakash, **A J Varma**, Asmita Prabhune, Yogesh Shouche and Mala Rao  
Bioresource Technology 102(3):3304-8 (2011)
- 91 Organic solvent facilitates acid hydrolysis of pretreated sugarcane bagasse polysaccharides for production of ethanol  
Anil H. Valekar<sup>1</sup>, Chandrashekhar M. Malba, Mukund G. Adsul, Digambar V. Gokhale, and **Anjani J. Varma**  
Trends in Carbohydrate Research, 2(3), 10-14 (2010)
- 90 Production of single cell protein, essential amino acids and xylanase by *penicillium janthinellum*  
Mala Rao,<sup>a</sup> A. J. Varma<sup>b</sup> and Sumedha S. Deshmukh<sup>a,\*</sup>  
BioResources 5(4), 2470-2477 (2010)
- 89 D(-)Lactic acid production from cellobiose and cellulose by *Lactobacillus lactis* mutant RM2-24  
M.S.Singhvi, M. G. Adsul, **A. J. Varma**, and D. V. Gokhale  
Green Chemistry, 12, 1106-1109 (2010)
- 88 Cellulases from *penicillium janthinellum* mutants: solid-state production and their stability in ionic liquids  
M. G. Adsul, A. P. Terwadkar, **A. J. Varma**, and D. V. Gokhale  
Bioresources, 4(4),1669-1680 (2009)
- 87 Hydrolysis of cellulose derived from steam exploded bagasse by *Penicillium* cellulases: Comparison with commercial cellulase  
Rajkumar Singh, **A.J.Varma**, R. Seeta Laxman and Mala Rao  
Bioresource Technology, 100(24), 6679-6681 (2009)
- 86 Pretreatment of plant biomass carbohydrates for ethanol production: An overview  
**A.J.Varma**,  
Trends in Carbohydrate Research, 1(2), 10-15, (2009)
- 85 Metal complexes of crosslinked chitosans : correlations between metal ion complexation values and thermal properties  
K.D.Trimukhe and **A.J.Varma**  
Carbohydrate Polymers, 75(1), 63-70 (2009)
- 84 Utilization of sugarcane bagasse cellulose for producing cellulose acetates: Novel use of residual hemicellulose as plasticizer  
H.M.Shaikh, K.V.Pandare, G.Nair, and **A.J.Varma**  
Carbohydrate Polymers, 76, 23-29 (2009)
- 83 Environment friendly crosslinked chitosan as a matrix for selective adsorption and purification of lipase of *Aspergillus niger*  
K.D.Trimukhe, N.Mahadik, D.V.Gokhale , **A. J.Varma**  
International Journal of Biological Macromolecules, 43, 422-425, (2008)

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- 82 A morphological study of heavy metal complexes of chitosan and crosslinked chitosans by SEM and WAXRD  
K.D.Trimukhe and **A.J.Varma**  
Carbohydrate Polymers 71, 698-702 (2008)
- 81 Complexation of heavy metals by crosslinked chitin and its deacetylated derivatives  
K.D.Trimukhe and **A.J.Varma**  
Carbohydrate Polym., 71, 66-73 (2008)
- 80 Metal complexes of crosslinked chitosans : Part II - An investigation of their hydrolysis to chitooligosaccharides using chitosanase  
K.D.Trimukhe, S.Bachate, D.V.Gokhale, **A.J.Varma**  
International J. of Biological Macromolecules 41, 491-496 (2007)
- 79 Sugar-linked biodegradable polymers : regio-specific ester bonds of glucose hydroxyls in their reaction with maleic anhydride functionalized polystyrene and elucidation of the polymer structures formed  
P.Galgali, M.Agashe, **A.J.Varma**  
Carbohydrate Polym., 67(4), 576-585, 2007
- 78 Lactic acid production from waste sugarcanebagasse derived cellulose  
M.G.Adsul, **A.J.Varma**, D.V.Gokhale  
Green Chemistry 9: 58-62, 2007
- 77 Strain improvement of Penicillium janthinellum NCIM 1171for cellulase production  
Mukund G. Adsul, Kulbhushan B. Bastawde, **Anjani J.Varma**, Digambar V. Gokhale  
Bioresource Technology 98: 1467-1473 (2007)
- 76 Carbohydrates . the future reservoirs of chemicals  
**A.J.Varma**  
Chemical Industry Digest, Blockdale, Mumbai, pp.42-46, June 2006
- 75 Enzymatic hydrolysis of delignified bagasse polysaccharides  
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